

## CLAIMS

- 1 1. An optical detection system comprising :
- 2 a) at least one electromagnetic radiation source directing source
- 3 radiation at a sample platform containing at least one sample;
- 4 b) at least one source radiation focusing and collimating means,
- 5 positioned between the radiation source and the sample for
- 6 focusing the directed source radiation onto the sample;
- 7 c) at least one photodetector adapted for receiving radiation
- 8 emitted from the sample;
- 9 d) at least one emitted radiation focusing means, positioned
- 10 between the photodetector and the sample, for focusing the
- 11 emitted light onto the photodetector; and
- 12 e) at least one source radiation blocking panel, positioned
- 13 between the excitation light focusing means and the sample, for
- 14 blocking extraneous radiation, said panel having at least one
- 15 pinhole wherethrough source radiation can pass, said pinhole
- 16 provided in a position adjacent to the sample such that
- 17 collimated source radiation is directed onto the sample.
- 1 2. An optical detection system according to claim 1 wherein the sample
- 2 platform comprises at least one microfabricated channel, a
- 3 microfabricated array electrophoresis chip, at least one capillary
- 4 column, or at least one flow cell.

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- 1 3. An optical detection system according to claim 1 wherein the sample  
2 platform is further connected to a power supply for electrophoresis or  
3 chromatography, such that optical detection can be performed  
4 concomitantly with electrophoresis or chromatography.
- 1 4. An optical detection system according to claim 1 wherein the sample  
2 platform is further connected to a pressure control system or a flow  
3 control system for chromatography, such that optical detection can be  
4 performed concomitantly with chromatography
- 1 5. An optical detection system according to claim 1 wherein  
2 a dichroic beamsplitter, disposed between the source radiation  
3 ~~focusing and collimating means and the photodetector, is~~  
4 provided for reflecting the source radiation onto the sample,  
5 and refracting the emitted radiation onto the photodetector;  
6 the photodetector, the emitted radiation focusing means, the  
7 dichroic beamsplitter, the source radiation focusing and  
8 collimating means and the sample are arranged in a manner  
9 such that source radiation is focused onto said sample, and  
10 focused emitted radiation is collected by said photodetector;  
11 the source radiation, comprising an excitation radiation, is  
12 directed at the dichroic beamsplitter; and  
13 a long pass filter is disposed between the dichroic beamsplitter  
14 and the emitted radiation focusing means for preventing source  
15 radiation from reaching the photodetector, such that epi-  
16 fluorescence detection is achieved.

- 1 6. An optical detection system according to claim 5 wherein the  
2 photodetector, the emitted radiation focusing means, the dichroic  
3 beamsplitter, the source radiation focusing and collimating means and  
4 the sample are disposed along one plane in this stated order.
- 1 7. An optical detection system according to claim 5 further comprising an  
2 interference filter provided between the dichroic beamsplitter and the  
3 radiation source for isolating a pre-set excitation wavelength.
- 1 8. An optical detection system according to claim 5 further comprising a  
2 rotatable filter wheel controlled by a rotor, said filter wheel, positioned  
3 between the photodetector and the long pass filter, for the  
4 transmission of emitted radiation of selected wavelengths from the  
5 sample to the photodetector.
- 1 9. An optical detection system according to claim 5 wherein a plurality of  
2 pinholes are disposed on the source radiation blocking panel at  
3 predetermined distances, said predetermined distance being the  
4 distance or a multiple of the distance between the samples arranged  
5 in an array.
- 1 10. An optical detection system according to claim 1 wherein  
2 a plurality of directing means are provided to reflect, transmit and  
3 refract the source radiation at the sample from opposing first and  
4 second directions;  
5 at least one pair of first and second pinholes provided on the source  
6 radiation blocking panel such that source radiation from the first  
7 direction can pass through the first pinhole into the sample, and

8 emitted light is emitted through the first pinhole, and source radiation  
9 from the second direction can pass through the second pinhole into  
10 the sample, and emitted light is emitted through the second pinhole;  
11 and

12 the source radiation focusing and collimating means comprises a first  
13 and second convergent cylindrical rectangular lens disposed across  
14 the path of the source radiation from said first and second directions  
15 respectively for focusing the source radiation onto the first and second  
16 pinholes.

1 11. An optical detection system according to claim 10 wherein the plurality  
2 of directing means comprises a set of mirrors which split the source  
3 radiation into a first excitation wavelength in the first direction and a  
4 second excitation wavelength in the second direction.

1 12. An optical detection system according to claim 10 wherein the plurality  
2 of directing means comprises a set of mirrors disposed at angles such  
3 that the first and second directions of radiation are both 45 degrees  
4 above the plane of the sample platform.

1 13. An optical detection system according to claim 10 wherein  
2 the sample platform comprises an array of channels aligned in  
3 parallel;  
4 the blocking panel comprises a plurality of pairs of pinholes aligned  
5 longitudinally in a parallel array, each pair of pinholes positioned  
6 directly above a channel of the sample platform; and

7 the first and second convergent cylindrical rectangular lens focusing  
 8 the source radiation from said first and second direction into a first  
 9 color line and a second color line, said first color line directed at the  
 10 row of first pinholes and said second color line directed at said row of  
 11 second pinholes.

1 14. An optical detection system according to claim 5 wherein the emitted  
 2 radiation focusing means comprises a convergent cylindrical  
 3 rectangular lens.

1 15. An optical detection system according to claim 14 further comprising  
 2 an emitted radiation blocking panel with pinholes provided between  
 3 the emitted radiation focusing means and the photodetector.

1 16. An optical detection system according to claim 14 wherein an  
 2 interference filter is provided between the dichroic beamsplitter and  
 3 the radiation source for isolating a pre-set excitation wavelength.

1 17. An optical detection system according to claim 5 further comprising  
 2 a second dichroic beamsplitter, disposed between the dichroic  
 3 beamsplitter and the long pass filter, for splitting the emitted  
 4 radiation into a first wavelength radiation and a second higher  
 5 wavelength radiation, such that said first wavelength radiation is  
 6 reflected, and said second higher wavelength radiation is refracted  
 7 to said long pass filter;

8 a second photodetector provided for receiving said first  
 9 wavelength radiation reflected by said second dichroic  
 10 beamsplitter; and

11 a second emitted radiation focusing means disposed between the  
12 second photodetector and the second dichroic beamsplitter for  
13 focusing said first wavelength radiation onto said second  
14 photodetector.

1 18. An optical detection system according to claim 17 further comprising  
2 an interference filter disposed between the dichroic beamsplitter and  
3 the radiation source for isolating a pre-set excitation wavelength.

1 19. An optical detection system according to claim 17 further comprising a  
2 second interference filter disposed between the second dichroic  
3 beamsplitter and the second photodetector for isolating a pre-set  
4 excitation wavelength.

1 20. An optical detection system according to claim 17 further comprising  
2 an emitted radiation blocking panel with at least one pinhole disposed  
3 between the emitted radiation focusing means and the photodetector,  
4 said pinhole wherethrough collimated emitted radiation can pass.

1 21. An optical detection system according to claim 20 further comprising  
2 an second emitted radiation blocking panel with at least one pinhole  
3 disposed between the second emitted radiation focusing means and  
4 the second photodetector, said pinhole wherethrough collimated  
5 second higher wavelength radiation can pass.

1 22. An optical detection system according to claim 17 further comprising a  
2 amplifier connected to said photodetector, and a second amplifier  
3 connected to said second photodetector.

1 23. An optical detection system according to claim 22 further comprising a  
2 computer or data processor connected to said amplifier, and a second  
3 computer or second data processor connected to said second  
4 amplifier.

1 24. An optical detection system according to claim 1 wherein said emitted  
2 radiation focusing means comprises  
3 a first and second convergent cylindrical rectangular lens; and  
4 an emitted radiation blocking panel with at least one pinhole;  
5 said first convergent cylindrical rectangular lens proximate said  
6 sample platform for collecting radiation emitting from said sample  
7 platform and focusing said emitted radiation onto said second  
8 convergent cylindrical rectangular lens, said second convergent  
9 cylindrical rectangular lens directing said focused light onto said  
10 photodetector via said pinhole of said emitted radiation blocking  
11 panel.

1 25. An optical detection system according to claim 24 wherein the emitted  
2 radiation is transmitted radiation not absorbed by sample.

1 26. An optical detection system according to claim 1, 5, 9, 13, 16 or 24  
2 wherein the source radiation blocking panel is made of a radiation  
3 absorbing material and further comprises a plurality of pinholes which  
4 are disposed above each of said samples.

1 27. An optical detection system according to claim 5, 9, 13, 16 or 24  
2 wherein said source radiation blocking panel is made of radiation

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3 absoorbing material; and scanning means, connected to said source  
 4 radiation blocking panel, are provided for shifting the source radiation  
 5 blocking panel at predetermined distances and predetermined time  
 6 intervals, said predetermined distance being the distance or a multiple  
 7 of the distance between the different samples arranged in an array;  
 8 and said predetermined time interval being the time used to collect  
 9 emitted radiation from each sample via said pinhole.

1 28. An optical detection system according to claim 1, 5, 9, 13, 16 or 24  
 2 wherein the source radiation focusing and collimating means is a  
 3 convergent cylindrical rectangular lens.

1 29. An optical detection system according to claim 1, 5, 9, 13 or 16  
 2 wherein the emitted radiation focusing means is a convergent  
 3 cylindrical rectangular lens.

1 30. An optical detection system according to claim 1, 9, 13, 16 or 24  
 2 wherein a plurality of pinholes are disposed on the excitation blocking  
 3 panel at predetermined distances, said predetermined distance being  
 4 the distance or a multiple of the distance between the samples  
 5 arranged in an array.

1 31. An optical detection system according to claim 1, 5, 9, 13 or 16  
 2 wherein the source radiation is excitation light and the emitted  
 3 radiation is fluorescence light.

1 32. An optical detection system according to any one of claims 1, 5, 9, 13,  
 2 16 or 24, wherein the photodetector is connected to an amplifier.



- 1 33. An optical detection system according to any one of claims 1, 5, 9, 13,  
2 16 or 24 wherein the photodetector is connected to a computer or a  
3 data processor.
- 1 34. An optical detection system according to claim 1 wherein the radiation  
2 source comprises a laser lamp, mercury lamp, xenon lamp or  
3 deuterium lamp.
- 1 35. An optical detection system according to claim 1 wherein the  
2 photodetector comprises at least one photodiode, a photodiode array,  
3 a photomultiplier tube or a charge couple device.
- 1 36. An optical detection system according to claim 1 wherein the pinholes  
2 are circular, and the diameter of the pinhole range between 1 to  
3 1,000 $\mu$ m.
- 1 37. An optical detection system according to claim 1 wherein the pinholes  
2 are rectangular in shape with the sides of the rectangle within 1 to  
3 1,000 $\mu$ m.
- 1 38. An optical detection system according to claim 1 wherein the emitted  
2 radiation focusing means is a convex lens.
- 1 39. An optical detection system according to claim 3 wherein the plurality  
2 of channels or columns are longitudinally aligned.
- 1 40. An optical detection system according to claim 39 wherein the plurality  
2 of channels or columns are longitudinally aligned in parallel along  
3 one plane.

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